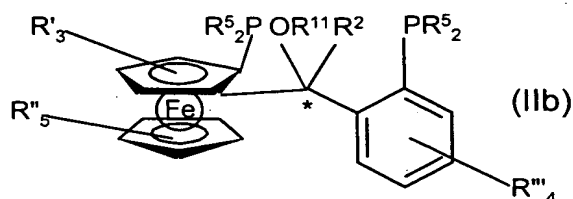
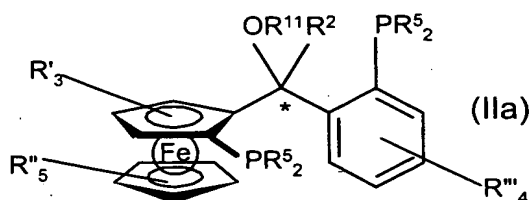


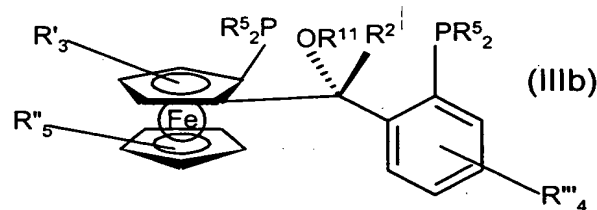
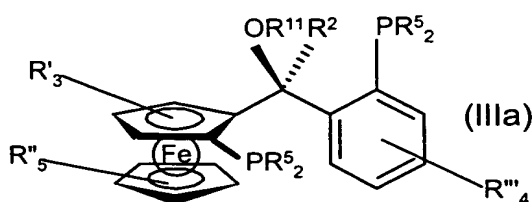
## Claims:

1. A ferrocenyl ligand of the general formula (II)



characterized in that

the  $S_{fc}, S$  enantiomer of the formula (IIIa) is present in excess in the stereoisomer mixture (IIa) or the  $R_{fc}, R$  enantiomer of the formula (IIIb) is present in excess in the stereoisomer mixture (IIb)



and

$R'$  and  $R''$  are radicals which can be selected independently from the group consisting of H and  $CH_3$  or can be a linker which connects the ligands to a polymeric support and the radicals

$R'''$  are radicals which can be selected independently from the group consisting of H and  $(C_1-C_4)$ -alkyl and the radicals

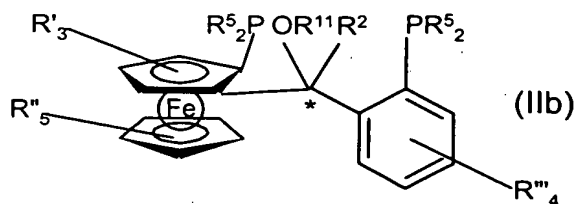
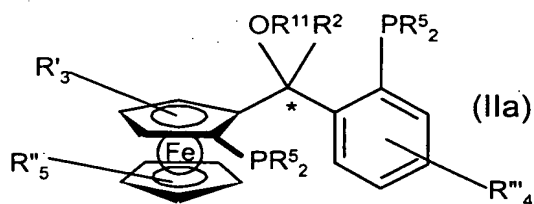
$R^5$  can be, independently of one another, radicals selected from the group consisting of  $C_6$ -aryl,  $C_5-C_6$ -cycloalkyl, adamantyl and  $C_1-C_4$ -alkyl, where the radicals  $R^5$  may bear one or more  $(C_1-C_4)$ -alkyl substituents and

$R^2$  is hydrogen or a  $(C_1-C_4)$ -alkyl radical and

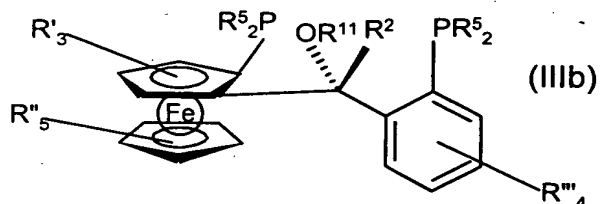
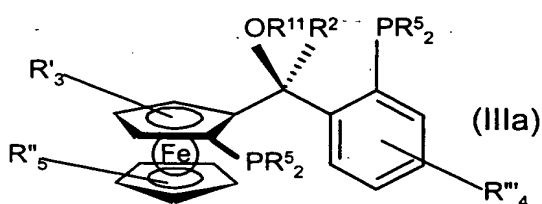
$R^{11}$  is a (C<sub>1</sub>-C<sub>4</sub>)-alkyl radical.

2. The ferrocenyl ligand as claimed in claim 1, characterized in that  
 $R^{11}$  is a methyl radical and/or  
5  $R^2$  is H or a methyl radical and/or  
 $R'$ ,  $R''$ ,  $R'''$  are hydrogen radicals and/or the radicals  
 $R^5$  are, independently of one another, phenyl, tolyl or xylyl radicals.
3. The ferrocenyl ligand as claimed in either claim 1 or 2, characterized in that the  
10  $S_{fc}, S$  enantiomer or the  $R_{fc}, R$  enantiomer is present in the stereoisomer mixture  
in a proportion of over 60%.
4. The ferrocenyl ligand as claimed in any of claims 1 to 3, characterized in that  
15 the ligand is present as  $S_{fc}, S$  enantiomer or as  $R_{fc}, R$  enantiomer having a purity  
of over 99%.
5. The use of ferrocenyl ligands as claimed in any of claims 1 to 4 for preparing  
complexes.
- 20 6. The use of ferrocenyl ligands as claimed in claim 5 for preparing complexes  
with metals, metal salts or metal precomplexes of transition group 7 or 8.
7. The use of ferrocenyl ligands as claimed in any of claims 1 to 4 in the  
asymmetric hydrogenation or hydroformylation of unsaturated organic  
25 compounds.
8. The use of ferrocenyl ligands as claimed in claim 7 in the asymmetric  
hydrogenation of C=C, C=O or C=N bonds.

9. A process for preparing ferrocenyl ligands of the general formula (II)



where the  $S_{fc}, S$  enantiomer of the formula (IIa) is present in excess in the mixture (IIa) or the  $R_{fc}, R$  enantiomer of the formula (IIb) is present in excess in the mixture (IIb)



and

$R'$  and  $R''$  can each be, independently of one another, a substituent selected from the group consisting of H and (C<sub>1</sub>-C<sub>4</sub>)-alkyl or a linker which connects the ligands to a polymeric support and the radicals

$R'''$  are radicals which can be selected independently from the group consisting of H, (C<sub>1</sub>-C<sub>18</sub>)-alkyl, (C<sub>1</sub>-C<sub>18</sub>)-alkoxy, (C<sub>1</sub>-C<sub>18</sub>)-acyloxy, (C<sub>6</sub>-C<sub>14</sub>)-aryl, (C<sub>3</sub>-C<sub>18</sub>)-heteroaryl, (C<sub>2</sub>-C<sub>17</sub>)-heteroalkyl, (C<sub>3</sub>-C<sub>8</sub>)-cycloalkyl and (C<sub>2</sub>-C<sub>10</sub>)-alkenyl, where two adjacent radicals may also be joined to one another to form a ring system, and the radicals

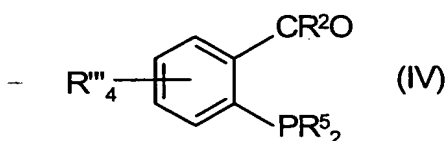
$R^5$  can each be, independently of one another, (C<sub>1</sub>-C<sub>18</sub>)-alkyl, (C<sub>6</sub>-C<sub>18</sub>)-aryl, (C<sub>6</sub>-C<sub>18</sub>)-aryl-(C<sub>1</sub>-C<sub>8</sub>)-alkyl, (C<sub>3</sub>-C<sub>18</sub>)-heteroaryl, (C<sub>3</sub>-C<sub>18</sub>)-heteroaryl-(C<sub>1</sub>-C<sub>8</sub>)-alkyl, (C<sub>2</sub>-C<sub>17</sub>)-heteroalkyl, (C<sub>3</sub>-C<sub>8</sub>)-cycloalkyl, (C<sub>3</sub>-C<sub>8</sub>)-cycloalkyl-(C<sub>1</sub>-C<sub>8</sub>)-alkyl, (C<sub>2</sub>-C<sub>10</sub>)-alkenyl radicals which may bear one or more (C<sub>1</sub>-C<sub>4</sub>)-alkyl substituents and the radical

$R^2$  is H or a (C<sub>1</sub>-C<sub>8</sub>)-alkyl radical, (C<sub>6</sub>-C<sub>18</sub>)-aryl, (C<sub>6</sub>-C<sub>18</sub>)-aryl-(C<sub>1</sub>-C<sub>8</sub>)-alkyl radical and the radical

$R^{11}$  can be a (C<sub>1</sub>-C<sub>18</sub>)-alkyl, (C<sub>6</sub>-C<sub>18</sub>)-aryl, (C<sub>6</sub>-C<sub>18</sub>)-aryl-(C<sub>1</sub>-C<sub>8</sub>)-alkyl radical,

which comprises the process steps:

- a) coupling of a chiral ferrocenyl sulfoxide with an aromatic aldehyde of the formula (IV),



with the chiral ferrocenyl sulfoxide being lithiated in the presence of a lithium base and the coupling of the aromatic aldehyde subsequently being carried out by transmetallation in the presence of a metal catalyst of transition group 8,

- b) coupling of the free OH group on the chiral center of the reaction product from step a) with an organic radical  $R^{11}$  by addition of the corresponding halide  $R^{11}\text{Hal}$  in the presence of an alkali metal hydride and
- c) replacement of the sulfoxide group of the reaction product from step b) in the presence of a strong lithium base by a phosphorus halide of the formula  $\text{HalPR}^5_2$ .

10. The process as claimed in claim 9, characterized in that the diastereomers obtained from step a) and/or the diastereomers from step b) are separated prior to being reacted further.